National Aeronautics and Space Administration

SENSOR TECHNOLOGY *Opportunity*

Monitoring Method and Apparatus Using Asynchronous, One-Way Transmission from Sensor to Base Station US Patent # 8,618,933 B2

Base Station

This invention is a monitoring system that includes a base station and at least one sensor unit mounted at some distance away, which is in wireless, one-way communication with the base station. The sensor lies dormant until it receives a voltage trigger from a vibration-sensitive switch which consumes no stored power from the battery. When activated, the sensor takes a measurement, transmits the data to the base station, and then returns to its dormant state. The taken measurement is recorded and time stamped.

This system was designed to improve the monitoring of high-geared and linearly-actuated ball valves used in rocket propulsion testing to more accurately predict valve life span and premature failure, though it's use is not limited to valves. The sensors can be used to monitor conditions on a variety of applicable structures.

Benefits

Compact Size: Each sensor unit is encapsulated in a small package that can be mounted within confined locations.

***Data Logging*:** Data events are logged and time stamped for data synchronization to within one millisecond. This enables alignment with events on other systems such as high speed data acquisition and high speed cameras.

System Design: The system is designed for a Class 1 Division II explosive environment. Units are monitored to safeguard against outside temperature limits, and may be potted in a fire retardant substance devoid of cavities, that could potentially confine hydrogen gas. The sensor can also include a solar panel for reducing or eliminating battery drain.

Smart Communication: The system uses asynchronous, one-way, wireless communication and a laminated piezoelectric sheet to enable highly sensitive vibration detection. The laminate produces a voltage to wake the microprocessor from sleep mode without requiring power from the sensor unit's batteries; thus reducing power consumption while maintaining accurate and reliable data transfer. In this way, the sensor unit establishes connectivity only when necessary, eliminating the need for continually powering a receiver.

***Monitoring*:** The monitoring system targets identified data events associated with degraded performance and failure. This reduces massive amounts of unnecessary data accumulation and alleviates issues with data storing, transmitting and interpretation.

The Technology

This monitoring system is a new integrated electronic technology, in the form of a base station and smart sensors, organized to provide a method of implementing a health monitoring system to manage performance and project failures of different types of valves. The system collects and records time stamped data of valve operations and aides in failure prediction and performance degradation.

Data collection types include: cryogenic cycles, total cycles, inlet / outlet temperature, body temperature, torsional strain, linear bonnet strain, preload position, total travel, and total directional changes. Data is recorded, time stamped and organized into a text file and stored in a compact flash memory card for database upload capability. It also includes an interface port for onboard programming and serial communication. Units are optimized for low power consumption, and for extended operational durations without maintenance.

Though designed to monitor high-geared ball and linearly-operated valves, this system it not limited to valves, and can be used to monitor the operational data of any suitable structure, such as the temperature in a particular location in a building, or the strain on a particular location on a bridge.

Commercial Opportunity

The system can be utilized in commercial applications that require long term monitoring of events associated with different types of strain, cryogenic / ambient temperatures, limit switches, 4-20 milliamps signals, 0-10 volt signal and magnetic fields.

Commercial Applications

Automotive Industry
Cryogenics
Petroleum Industry
Chemical Industry

Contact Information

If you require more information or are interested in pursuing commercialization of this technology, visit: https://quicklaunch.ndc.nasa.gov/,
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